1879MNRAS..40....8W

Comparison of Hansen's Coefficients of the Moon's Latitude with those of Plana and others. By R. Wilding, Esq.

The values of the coefficients of the terms in the expressions for the coordinates of the Moon having now been found by a number of independent calculators, I venture to suggest that, for the practical purpose of forming lunar tables, perhaps the best values to be adopted would be those which are found to agree most nearly, *especially* if obtained by methods entirely different in principle. When the results, under such circumstances, *very* nearly agree, it seems highly probable that they are correct except as regards variations which might be accounted for by the fact that different elements of the orbit are assumed in their calculation. In cases where the coefficients are given *literally* the latter discrepancy may be made to disappear.

A comparison is made by Hansen, in his "*Darlegung &c.*," between his coefficients of the Moon's longitude and those found by Plana and Damoiseau; but I am not aware that any similar one is made of his latitude with that of other writers, and I have therefore endeavoured to do so in the present paper.

For this purpose, Hansen's expression for the latitude has to be reduced to a series of terms having for arguments angles increasing *as* the time. His mode of deducing the latitude is peculiar. First, a kind of *mean sine* of the latitude is taken equal to (sine *constant* inclination) × (sine of *true* distance of Moon from *true* ascending node), and this is afterwards corrected by the addition of a number of small equations, the result being the *true* sine of the latitude. From this the latitude itself is then obtained.

From the above explanation it will be seen that the reduction of the whole to terms having arguments varying *as* the time is a matter of some complexity, and one in which there is great liability to error; so I must request that *too much* reliance should *not* be placed upon my figures, although I cannot help saying that they *appear* very correct, and have been honestly worked out.

The very remarkable agreement with those of Delaunay which they present induces me to give his coefficients also for comparison. It is true that both Hansen and he used the same elements (Airy's); but the processes employed were so vastly different that the close accordance of the results seems to indicate that they are both extremely correct.

Both Clausen (*Astron. Nach.*, No. 406) and Pontécoulant (*Théorie Analytique*) have compared Burckhardt's coefficients with those of Damoiseau and others; but, as Burckhardt's coefficients of *precisely* the same arguments differ very considerably as given by these two authorities, it is clear that one or both reductions are erroneous. Pontécoulant's reduction of Burckhardt's latitude seems certainly wrong, and has the effect of making it appear that Burckhardt's tables of latitude are much worse than they really are.

The arguments are those of Delaunay.

1879MNRAS..40....8W

$D = ☽ - ☉$ ⎫
$F = ☽ - ☊$ ⎪
$l = ☽$'s mean anomaly ⎬ All mean angles.
$l' = ☉$'s „ „ ⎭

Argument.	Delaunay.	Hansen.	
	″	″	
F	18461·3	18461·6	
$F+l$	+ 1010·2	+ 1010·3	
$F-l$	− 999·8	− 999·9	
$2D-F$	+ 623·6	+ 623·6	
$2D+F-l$	+ 199·3	+ 199·6	
$2D-F-l$	+ 166·4	+ 166·6	
$2D+F$	+ 117·2	+ 118·4	Dam. 117″·3; Plana 117″·6; Pont. 117″·5.
$F+2l$	+ 62·0	+ 62·0	
$2D-F+l$	+ 33·4	+ 33·0	
$F-2l$	− 32·3	− 31·8	
$2D-F-l'$	+ 29·7	+ 29·7	
$2D-F-2l'$	+ 15·3	+ 15·9	
$2D+F+l$	+ 15·1	+ 15·1	
$2D-F+l'$	− 12·2	− 12·2	
$2D+F-l-l'$	+ 9·0	+ 8·9	
$2D-F-l-l'$	+ 7·5	+ 9·3	Dam. 7″·4; Plana 8″·2; Pont. 8″·3.
$2D+F-l'$	+ 8·0	+ 8·0	
$F+l-l'$	+ 4·6	+ 6·8	Dam. 6″·8; Plana 6″·4; Pont. 6″·3. (I may have taken out Delaunay's coeff. wrongly.)
$4D-F-l$	+ 6·5	+ 7·7	Dam. 6″·3; Plana 6″·6; Pont. 6″·6.
$F-l+l'$	− 5·4	− 5·6	
$F+l'$	− 6·6	− 6·5	
$F+D$	− 5·3	− 5·5	
$3F$	− 6·3	− 6·3	
$F-D$	+ 4·8	+ 4·8	
$F+l+l'$	− 5·3	− 5·3	
$F-l-l'$	+ 5·0	+ 5·1	
$F+3l$	+ 4·0	+ 4·0	
$4D-F$	+ 3·7	+ 3·6	
$4D+F-l$	+ 2·8	+ 3·0	
$3F-l$	− 2·8	− 2·8	
$F-l'$	+ 4·9	+ 4·9	
$3F-2D$	− 2·2	− 3·4	Dam. −2″·3; Plana −2″·4; Pont. −2″·3.
$4D+F-2l$	+ 2·3	+ 2·4	

1879MNRAS..40....8W

Argument.	Delaunay.	Hansen.	
	″	″	
$2D-F-3l$	+ 1·5	+ 2·1	
$2D-F+2l$	+ 2·1	+ 2·2	
$2D+F-2l$	− 1·7	− 1·4	
$2D-F+l-l'$	+ 1·8	+ 0·3	Dam. 1″·6; Plana 1″·6; Pont. 1″·6.
$2D+F+2l$	+ 1·5	+ 1·5	
$2D+F+l'$	− 1·2	− 1·2	
$2D+F-l+l'$	− 1·8	− 1·6	
$4D+F$	+ 1·1	+ 1·2	
$2D+F+l-l'$	+ 1·1	+ 1·1	
$F-D+l$	+ 0·4	+ 0·5	
$2D-F-2l'$	+ 1·1	+ 1·1	
$3F+l$	− 1·0	− 1·0	
$2D-F+l+l'$	− 0·8	− 0·8	
$F+2l-l'$	+ 0·7	+ 0·8	
$F-3l$	− 1·6	− 1·6	
$2D-F-l+l'$	− 1·2	− 0·9	Dam. −0″·8; Plana −1″·9 Pont. −2″·0.
$D+F+l$	− 0·6	− 0·7	

A close agreement is found to exist between the remaining small coefficients which are omitted. The coefficient of the term having for argument, Moon's true longitude, is also omitted, as I do not find that Delaunay has given his value of it.

Note on the Ellipticity of Mars, and its effect on the Motion of the Satellites. By Professor J. C. Adams.

One of the results of Professor Asaph Hall's able discussion of his observations of the satellites of *Mars* is to show that the orbits of both the satellites are at present inclined at small angles to the plane of the planet's equator. It becomes an interesting question to inquire whether this state of things is a permanent one. The plane of *Mars'* orbit is inclined to its equator at an angle of 27° or 28°. If then the planes of the orbits of the satellites retain constant inclinations to the orbit of the planet, as they would do if the Sun's disturbing force were the only force tending to alter those planes, their inclinations to the plane of *Mars'* equator, and still more their inclinations to each other, would in time become considerable.

In No. 2280 of the *Astronomische Nachrichten*, Mr. Marth has found the motions of the nodes of the orbits of the satellites on the orbit of the planet due to the Sun's action, and he con-